PETROLEUM REFINING PROCESS WASTE LISTING DETERMINATION

SUPPLEMENTAL BACKGROUND DOCUMENT

GROUNDWATER PATHWAY RISK ANALYSIS

US Environmental Protection Agency
Office of Solid Waste
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the waste management unit and regional recharge.The saturated zone transport module accounts for three-dimensional advection and dispersion, chained-decay reactions involving up to seven different chemical species (*i.e.*, parent compound and up to six daughter products), and linear or nonlinear equilibrium sorption. EPACMTP simulates steadystate flow in both the unsaturated zone and the saturated zone; contaminant transport can be either steady state or transient. The steady state modeling option is used for continuous source modeling scenarios; the transient modeling option is used for finite source modeling scenarios, with optional accounting for source depletion. EPACMTP predicts the contaminant concentration arriving at a down gradient groundwater receptor well. This can be either a steady state concentration value, corresponding to the continuous source scenario, or a time-dependent concentration, corresponding to the finite source scenario. In the latter case, the modelcan calculate either the peak concentration arriving at the well, or a time averaged concentration, corresponding to a specified exposure duration, *e.g.*, a nine year average residence time. EPACMTP has the capability to perform Monte Carlo simulations to account for parametric uncertainty or variability. The flow and transport simulation modules of EPACMTP are linked to a Monte Carlo driver which permits a probabilistic evaluation of uncertainty in model input parameters, as described by specified (joint) probability distributions.

EPACMTP replaces the EPA's Composite Model for Landfills (EPACML) which was used in 1990 Toxicity Characteristic (TC) Rule (55FR11798). EPACMTP extends the capabilities of the earlier EPACML model. The enhanced capabilities include accounting for three-dimensional groundwater flow, the finite source and transformation products options, and capability to simulate metals transport with nonlinear sorption isotherms through linkage with the MINTEQ geochemical speciation model. EPACMTP has been published in an international refereed journal (Kool, Huyakorn, Sudicky, and Saleem, 1994). It also has been extensively reviewed. The SAB (USEPA's Science Advisory Board) commended the Agency for its significant improvements to the model. They also stated that it represents the state of the art for such analyses. However, they also encouraged additional validation studies, especially for the metals (USEPA, 1995c).

2.1.2 Contaminant Source Term Modeling

The release of contaminants into the subsurface constitutes the source term for the fate and transport model. The conceptual differences between a landfill and other waste management scenarios are reflected in how the modelsource term is characterized in different scenarios. The modeled subsurface fate and transport processes are the same for each waste management scenario. The contaminant source term for the EPACMTP fate and transport model is defined in terms of four primary parameters: (1) area of the waste unit, (2) leachate flux rate emanating from the waste unit, (3) leachate concentration of each constituent, and (4) duration of the constituent release. Information on the on-site waste unit areas was obtained from responses to the 1992 RCRA §3007 Questionnaire of the Petroleum RefiningIndustry (1992 RCRA §3007 Survey Database). The off-site unit areas were obtained from the USEPA Office of Solid Waste (OSW) Industrial Subtitle D Waste Management Facility Database (USEPA, 1996c;USEPA, 1997d). Leachate flux and contaminant release rates were determined as a function of the design and operational characteristics of the different waste management and wastestream characteristics

6.0 REFERENCES

1992 RCRA §3007 Survey of the Petroleum Refining Industry Database.

API, 1989. Hydrogeologic Database for Groundwater Modeling, API Publication No. 4476, American Petroleum Institute.

Chappelle, F.M., 1993. Groundwater Microbiology and Geochemistry. John Wiley and Sons, New York.

Kool, J.B., P.S. Huyakorn, E.A. Sudicky, and Z.A. Saleem, 1994. A composite modeling approach for subsurface transport of degrading contaminants from land disposal sites. *Journal of Contaminant Hydrology*, vol.17 pp. 69-90.

Kollig, H.P., J.J. Ellington, E.J. Weber, and N.L. Wolfe. Pathway analysis of chemical hydrolysis for 14 RCRA chemicals. U.S. EPA Environmental Research Brief, EPA/600/M-89/009.

Krumholtz, L., M.E. Caldwell and J.M Suflita. 1996. Biodegradation of BTEX Hydrocarbons Under Anaerobic conditions. Chapter in "Bioremediation: Principals and Applications" R. Crawford & D. Crawford, eds. Cambridge University Press.

Newell, C.J., L. P. Hopkins, and P. B. Bedient, 1990. A Hydrogeologic Database for Ground-Water Modeling. *Groundwater*, Vol. 28, No. 5, pp. 703-714.

RCRA CBI Documents, 1995. Document Control Numbers BP9500077 and BP9500086. (On and OffsitePetroleum Refining Waste Landfill Statistics).

Salinitro, J.P., 1993. The Role of Bioattenuation in the Management of Aromatic Hydrocarbon Plumes in Aquifers. Groundwater Monitoring and Remediation, p. 1-29. Batelle Press. Columbus, Ohio.

USEPA, 1988. Draft National Survey of Solid Waste (Municipal) Landfill Facilities, EPA/530-SW-88-034, U.S. Environmental Protection Agency, Washington D.C.

USEPA, 1989. USEPA Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual. Washington D.C., 20460.

USEPA, 1992. Guidance on Risk Characterization for Risk Managers, USEPA Memorandum, Washington, D.C., 20460.

USEPA, 1995a. Listing Background Document for the 1992-1996 Petroleum Refining Determination. U.S. EPA Office of Solid Waste, Washington, D.C., 20460.